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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103

SUBJECT: Region III Soil-to-Groundwater SSLs

FROM: Jennifer Hubbard, Toxicologist
Superfund Technical Support Section (3HS41)

TO: RBC Table Users

DATE: 10/27/99

The soil-to-groundwater Soil Screening Levels (SSLs) were added to the Risk-Based Concentration (RBC) table to increase the number of pathways addressed by the table, and therefore to improve the table's overall usefulness. This memo explains:

How the SSLs were derived; and
How the SSLs should be used for Region III Superfund projects.

DERIVATION OF THE SSLs

According to Equation 10 of EPA's Soil Screening Guidance: User's Guide (April 1996, Publication 9355.4-23), a soil screening level protective of chemical migration to groundwater can be derived as follows:

$$\text{SSL (mg/kg)} = C_w \times [K_d + (\theta_w + \theta_a H') / \rho_b]$$

where:

C_w = Target soil leachate concentration (mg/L)

K_d = Soil-water partition coefficient (L/kg)

θ_w = Water-filled soil porosity (L water/L soil)

θ_a = Air-filled soil porosity (L air / L soil)

ρ_b = Dry soil bulk density (kg/L)

H' = Dimensionless Henry's Law constant

For the Region III SSLs, the guidance's defaults were adopted for the following factors:

$$\theta_w = 0.3$$

$$\theta_a = 0.134$$

$$\rho_b = 1.5$$

For K_d where K_d was derived from $K_{oc} \times FOC$, the default FOC of 0.002 was also adopted.

Chemical-specific values for K_d , K_{oc} , and H' were compiled by Dr. David Kargbo, EPA Region III soil scientist. Dr. Kargbo conducted a comprehensive literature search, and the results are summarized under separate cover (SSLRBC2, listing SSL background information; and SSLREF, listing the references for this information). Where values were pH-dependent, those based on a pH of 6.8 were used (6.8 is the average pH used in the Soil Screening Guidance, and is also considered reasonable for the states and commonwealths of Region III). If any of these values differ from values shown in the 1996 guidance or in other EPA tables, the differences may be due to any of several reasons, including:

- difference in assumptions due to varying soil conditions in different areas of the United States;

- variations in experimental results reported in the literature.

It should be noted that the Region III generic SSLs are only suggested defaults, and as such, may be superseded at any site by the development of site-specific numbers.

For the Region III SSLs, C_w was simply the Region III tap water RBC, multiplied by the appropriate dilution attenuation factor (DAF). DAFs of 1 and 20 were used for the table, consistent with the SSL Guidance and with EPA Region IX PRGs, but other DAFs may be appropriate for site-specific situations. SSLs for other DAFs may be obtained by simply multiplying the SSL at DAF 1 by the new DAF. Therefore, users will notice that the SSLs at DAF 20 are 20 times the SSLs at DAF 1.

The Soil Screening Guidance suggests ARARs, specifically Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs), for C_w . For users who wish to see SSLs based on MCLs and MCLGs, the SSL Guidance has already done this as part of Appendix A of the Soil Screening Guidance: Technical Background Document (May 1996, EPA/540/R-95/128). Therefore, Region III felt that it would be redundant to reproduce those numbers here. Also, for users who need consistency among RBCs, the Region III SSLs correspond directly to the Region III tap water RBCs.

The Soil Screening Guidance also uses the concept of C_{sat} , the saturation concentration of soil. Essentially, this is a limiting factor on soil concentration. In other words, some of the concentrations may not be physically achievable. Because the RBC table focuses on risk-based numbers, C_{sat} is not shown on this table. This allows users to consider other risk levels (e.g., Hazard Quotients of 0.1) by simple scaling, which would be impossible if numbers were cut off at C_{sat} .

If users wish to consider C_{sat} , instructions for its derivation are in the national SSL Guidance. As the Guidance notes, exceedance of C_{sat} may indicate a potential for nonaqueous phase liquid (NAPL). Because the soil-to-groundwater numbers are relatively low, SSLs above C_{sat} rarely occur for this pathway.

APPLICATION OF THE SOIL-TO-GROUNDWATER SSLs

The Region III SSLs, like the Region III RBCs, are designed purely for screening purposes. Exceedance of screening levels typically means that more detailed assessment is necessary. Therefore, these numbers are not intended as cleanup levels, nor are they intended as

trigger levels that require remediation.

The risk assessor and hydrogeologist will need to consider the following:

- Are the assumptions behind the SSLs relevant to my site? Should I derive site-specific SSLs?
- Is the DAF of 1 or 20 more appropriate for my site? Should I use yet another DAF and, if so, what?
- Are the assumptions behind the SSLs superseded by actual data from the site?

It may be necessary to consult with a soil scientist, project manager, or with other experts when answering these questions. At any site, the project team may elect to derive site-specific rather than generic SSLs, if the generic SSLs do not sufficiently meet data quality objectives.

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$\bullet w$ = Water-filled soil porosity (L water/L soil)

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- $\bullet w = 0.3$
- $\bullet a = 0.134$
- $\bullet b = 1.5$

For Kd where Kd was derived from Koc x FOC, the default FOC of 0.002 was also adopted.

Chemical-specific values for Kd, Koc, and H⁺ were compiled by Dr. David Kargbo, EPA Region III soil scientist. Dr. Kargbo conducted a comprehensive literature search, and the results are summarized under separate cover (SSLRBC2, listing SSL background information; and SSLREF, listing the references for this information). Where values were pH-dependent, those based on a pH of 6.8 were used (6.8 is the average pH used in the Soil Screening Guidance, and is also considered reasonable for the states and commonwealths of Region III). If any of these values differ from values shown in the 1996 guidance or in other EPA tables, the differences may be due to any of several reasons, including:

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If users wish to consider Csat, instructions for its derivation are in the national SSL Guidance. As the Guidance notes, exceedance of Csat may indicate a potential for nonaqueous phase liquid (NAPL). Because the soil-to-groundwater numbers are relatively low, SSLs above Csat rarely occur for this pathway.

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